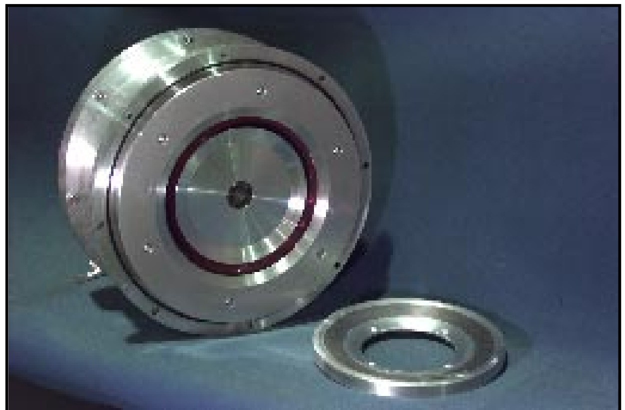
January 1995 Highlights of the Light Ion Inertial Confinement Fusion Program



Magnetically confined Anode Plasma ion diode invented by Cornell researchers that is capable of repetitive operation up to 100 Hz.

We prepared a brochure highlighting our collaboration with Cornell University, the University of Wisconsin, the University of New Mexico, and Weizmann Institute of Science in Israel. These partnerships have fostered the development of new ion diode concepts (see figure), nuclear diagnostics and spectroscopic techniques, computational models for beam-target interactions, and systems studies of light-ion-driven power plants.

Four 300-500 kJ capacitor banks have been ordered and are expected to arrive by fall. These banks should enable a V_{crit}/V of at least three (and, hence, fewer electrons delivered to the anode) for divergence reduction experiments on SABRE. These divergence experiments will require an active anode source. We plan to use an exploding metal foil active anode plasma source (EMFAPS). Experiments at KfK in Karlsruhe, Germany, and at Cornell University indicate that focusing to a smaller spot size is possible with such a source.

We completed eight PBFA-II shots with the new anode hardware. A mechanical scheme has been developed to address failure of a cable passing through toroid 4 to the RF discharge cleaning hardware: the cable will be placed within a bellows to conduct heat away, and a matching capacitor will be added. The cable failure occurs at 200 watts because of an impedance mismatch between the 600-watt RF generator and the cleaning plasma. On the Integrated Test Facility, we are testing plasma probes that will quantify the cleaning technique by measuring the ion flux and temperature after the glow discharge is initiated.

Anode heating hardware for the PBFA-II cleaning series is expected to arrive by the end of February. Checkout of the Laser EVaporation Ion Source (LEVIS) hardware and the new LEVIS laser has been done on two downline shots. The new neodymium glass laser, which was previously tested in the light lab, has a subnanosecond jitter, compared to the 10-20 ns jitter of the earlier laser used for PBFA-II LEVIS experiments. This active anode source will be available for use once the anode cleaning techniques are operational. In the two LEVIS shots, we observed earlier source turn on and higher efficiency than with the passive LiF source but, as expected, significant protons were emitted from the dirty anode.

Open cone and closed cylinder hohlraums are being fabricated for the next lithium target series on PBFA II. We are postponing the series to allow time to optimize beam intensity with the new anode cleaning hardware. In the first lithium target experiments, in March 1993, x-ray emission from the equatorial region of the cone demonstrated the effect of the CH_2 foam in symmetrizing energy deposited by the incoming ion beam; the same diagnostic will be used in the upcoming series.

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